(12) UK Patent Application (19) GB (11) 2 229 041 (13) A

(43) Date of A publication 12.09.1990

(21) Application No 8902067.1

(22) Date of filing 31.01.1989

(51) INT CL[5]
H05K 7/20

(52) UK CL (Edition K)
H1R RBK

(56) Documents cited
GB 2026767 A GB 1296302 A GB 1293730 A
EP 0146255 A2 EP 0065686 A2

(58) Field of search
UK CL (Edition J) C3T TKB, H1K KPDA KPDB KPDC KPDX, H1R RBK
INT CL[4] H01L, H05K

(71) Applicant
Electrolube Limited

(Incorporated in the United Kingdom)

Blakes Road, Wargrave, Berkshire, RG10 8AW, United Kingdom

(72) Inventor
Antonio Verissimo

(74) Agent and/or Address for Service
Reddie & Grose
16 Theobalds Road, London, WC1X 8PL, United Kingdom

(54) Electrical circuit heat sink

(57) A metal oxide-filled fluid resin which cures on exposure to ambient air, for example an RTV (room temperature vulcanisable) silicone elastomer, is used to form a heat transfer layer electrical circuit heat sink material. The resin may be applied to preformed heat sink material by screen printing.

GB 2 229 041 A

ELECTRICAL CIRCUIT HEAT SINK

The invention relates to the provision of heat transfer material for transferring heat between a heat generating electrical circuit component and a heat sink.

Presently available thermally conductive materials include thermally conductive grease (thermopath) and insulating silicone rubber pads (flexipads), which are supplied as a separate component for sandwiching between the heat-generating component and the preformed heat sink on assembly of the circuit.

The invention allows the supply of heat sinks preformed with a layer of heat transfer material, ready for direct placement of the heat generating component. The invention resides in the use of a metal oxide filled fluid resin that may be applied to the surface of the heat sink material and which will cure on exposure to ambient air, thus bonding to the surface of the material.

The resin should preferably be applied in a uniform layer. It has been found that this may be achieved by printing. Screen printing is a particularly preferred process.

The curable resin composition may be applied to a blank of heat sink material which may then be formed, if necessary, into a required shape. Usually a sheet of heat sink material sufficient to make several blanks will have the curable resin composition applied where appropriate and will then be formed into separate heat sinks. The heat sink material could for

example be aluminium, which can be anodized without disturbing the layer of heat transfer material.

The curable resin composition could be applied directly to a preshaped heat sink. Another possibility is to apply the curable resin composition to areas of exposed copper on circuit boards, such areas being specifically left exposed for use as heat sinks. In this case, there is no need for an additional heat sink component.

The curable resin composition may be applied over the entire heat sink surface or in a desired shape or shapes to fit the heat generating component(s). The areas of heat sink coated with the resin may be varied on demand.

Particularly useful curable resins for use in the invention are so-called room temperature vulcanisable (RTV) materials, in particular RTV silicone elastomers. Elastomeric or similar heat transfer layers can give good thermal contact with the heat sink material. At least some of the metal oxide filled materials are novel in themselves.

The optimum properties of the layer will vary according to the precise context. For example, the thermal conductivity of the heat transfer medium may be between 5 and 15 $mW/cm^{o}C$, and the dielectric strength around 18 kV/m.

The thermal conductivity of the cured resin composition is governed inter alia by the amount of metal oxide filler. An increase in the metal oxide concentration will increase the thermal conductivity, but depending on the metal oxide, may be to the detriment of the electrical insulating properties.

The viscosity of the curable resin composition is also dependent on the level of filler. For screen printing, it is preferred that the viscosity falls between 50 and 500 cSt.

It is necessary to avoid curing the curable materials during application. The application may be done under a blanket of nitrogen, or other shield gas, to prevent premature curing.

There are several aspects to this invention. Invention resides not only in the use of curable resin compositions for making heat sinks preformed with a layer of heat transfer material, but also in the finished composite heat sinks, the resin-coated blanks for making them, the resin-coated sheet material for forming the blanks, and in circuit boards with the resin composition applied to exposed copper areas. Furthermore, invention resides in the methods for making these products and intermediates, and in the novel metal oxide filled compositions per se.

CLAIMS :

1. The use of a metal oxide-filled fluid resin, which cures on exposure to ambient air, to preform a heat transfer layer on electrical circuit heat sink material.

2. A heat sink for dissipating heat from a heat generating electrical circuit component, the heat sink being preformed with a heat transfer component thereon by forming and curing on the heat sink material surface a layer of ambient air-curable metal oxide-filled fluid resin.

3. A method of preforming an electrical circuit heat sink combined with a heat transfer component thereon, the method comprising forming and curing on the heat sink material surface a layer of ambient air-curable metal oxide-filled fluid resin.

4. A method according to claim 3 wherein said layer is formed by screen printing.

5. A method according to claim 3 or 4 wherein the resin is an RTV silicone elastomer.

6. A metal oxide-filled fluid resin which is curable in ambient air to form a heat transfer medium for an electrical circuit heat sink.

Published 1990 at The Patent Office, State House, 66 71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd, St Mary Cray, Kent, Con. 1/87